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| APPLICATION NO.              | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|------------------------------|-------------|----------------------|---------------------|------------------|
| 09/912,737                   | 07/26/2001  | Luona Goh            | CS01-001            | 5502             |
| 28112                        | 7590        | 02/13/2004           | EXAMINER            |                  |
| GEORGE O. SAILE & ASSOCIATES |             |                      | BROPHY, JAMIE LYNN  |                  |
| 28 DAVIS AVENUE              |             |                      | ART UNIT            |                  |
| POUGHKEEPSIE, NY 12603       |             |                      | PAPER NUMBER        |                  |

2822

DATE MAILED: 02/13/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

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|                              |                                      |                                   |  |
|------------------------------|--------------------------------------|-----------------------------------|--|
| <b>Office Action Summary</b> | <b>Application No.</b><br>09/912,737 | <b>Applicant(s)</b><br>GOH ET AL. |  |
|                              | <b>Examiner</b><br>J. L. Brophy      | <b>Art Unit</b><br>2822           |  |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

#### Status

- 1) ☒ Responsive to communication(s) filed on 17 November 2003.
- 2a) ☒ This action is **FINAL**.                      2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

#### Disposition of Claims

- 4) ☒ Claim(s) 1,3-6,12,14-17 and 23-32 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1,3-6,12,14-17 and 23-32 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

#### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 26 July 2001 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

#### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \*    c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.

#### Attachment(s)

- |  |   |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892)   | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                                   | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____  |

### **DETAILED ACTION**

This office action is in response to the amendment filed 11/17/03.

#### ***Double Patenting***

Claims 24 and 28 are objected to under 37 CFR 1.75 as being a substantial duplicate of claims 5 and 16, respectively. When two claims in an application are duplicates or else are so close in content that they both cover the same thing, despite a slight difference in wording, it is proper after allowing one claim to object to the other as being a substantial duplicate of the allowed claim. See MPEP § 706.03(k).

#### ***Claim Rejections - 35 USC § 102***

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(e) the invention was described in-

(1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effect under this subsection of a national application published under section 122(b) only if the international application designating the United States was published under Article 21(2)(a) of such treaty in the English language; or  
(2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that a patent shall not be deemed filed in the United States for the purposes of this subsection based on the filing of an international application filed under the treaty defined in section 351(a).

Claims 1, 3 and 6 are rejected under 35 U.S.C. 102(b) as being anticipated by  
Publication No. JP08102489A.

Publication No. JP08102489A teaches a method that comprises depositing a low dielectric constant material layer 8 on a substrate 1, wherein said low dielectric constant material 8 is a plasma TEOS film that has a thickness between about 1000 and 2000 angstroms;

Implanting silicon ions 9 into said low dielectric constant material layer 8; and

Thereafter depositing a TEOS-based silicon oxide layer 11 overlying said low dielectric constant material 8, wherein the TEOS-based silicon oxide layer 11 has a thickness of 4000 to 6000 angstroms.

See Fig. 1 and English Abstract.

Claims 1, 3 and 6 are rejected under 35 U.S.C. 102(e) as being anticipated by Watanabe et al (6,214,749).

Watanabe et al teach a method that comprises depositing a low dielectric constant material layer 6 on a substrate 1, wherein said low dielectric constant material 6 is organic SOG that has a thickness of about 4000 angstroms;

Implanting silicon ions into said low dielectric constant material layer 6 (col. 9, line 25); and

Thereafter depositing a TEOS-based silicon oxide layer 8 overlying said low dielectric constant material 6, wherein the TEOS-based silicon oxide layer 8 has a thickness of 2000 angstroms.

See, for example, Figs. 2C and 3A and accompanying text.

***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 4, 5 and 24-27 are rejected under 35 U.S.C. 103(a) as being unpatentable over Publication No. JP08102489A or Watanabe et al.

Publication No. JP08102489A teaches a method that comprises implanting silicon ions into a dielectric layer as applied to claims 1, 3 and 6 above. In addition, Publication No. JP08102489A teaches that the silicon ions are implanted at a dosage of about  $1 \times 10^{11}$  and  $1 \times 10^{12}$  ions/cm<sup>2</sup>.

Watanabe et al teach a method that comprises implanting silicon ions into a dielectric layer as applied to claims 1, 3 and 6 above.

However, Publication No. JP08102489A does not specifically teach the implant energy or the implant depth. Watanabe et al do not specifically teach the implant energy, dosage or depth.

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to optimize and select an appropriate implant energy, dosage and depth for the silicon ions. The selection of parameters such as energy, power, concentration, temperature, time, depth, thickness, etc., would have been obvious and involve routine optimization which has been held to be within the level of ordinary skill in the art. "Normally, it is to be expected that a change in temperature, or in concentration,

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or in both, would be an unpatentable modification. Under some circumstances, however, changes such as these may be impart patentability to a process if the particular ranges claimed produce a new and unexpected result which is different in kind and not merely degree from results of prior art...such ranges are termed 'critical ranges' and the applicant has the burden of proving such criticality...More particularly, where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation". *In Re Aller* 105 USPQ 233, 235 (CCPA 1955). See also MPEP 2144.05.

Claims 12, 14-17, 23 and 28-32 are rejected under 35 U.S.C. 103(a) as being unpatentable over Watanabe et al.

Watanabe et al teach a method that comprises depositing a low dielectric constant material layer 6 on a substrate 1, wherein said low dielectric constant material 6 is organic SOG that has a thickness of about 4000 angstroms;

Implanting silicon ions into said low dielectric constant material layer 6 (col. 9, line 25);

Thereafter depositing a TEOS-based silicon oxide layer 8 overlying said low dielectric constant material 6, wherein the TEOS-based silicon oxide layer 8 has a thickness of 2000 angstroms;

Forming an opening 9 through the TEOS-based silicon oxide layer 8 and the low dielectric constant material layer 6; and

Forming a copper layer 10 (see col. 19, lines 36-41) within the opening 9.

See, for example, Figs. 2C to 3C and accompanying text.

However, Watanabe et al do not teach the additional steps of forming a second low dielectric constant material layer and a second TEOS-based silicon oxide layer. In addition, Watanabe et al do not specifically teach the step of forming a barrier layer in the opening. Watanabe et al do not specifically teach the implant energy, dosage or depth.

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to repeat the steps of forming a low dielectric constant material layer and forming a TEOS-based silicon oxide layer because it is well established that the mere repetition or duplication of a prior art process or means to accomplish an expected additive function or result is prima facie obvious absent a disclosure that the process is for a particular unobvious purpose, produces an unexpected result, or is otherwise critical. See, for example, *In re Ockert*, 114 USPQ 330 (CCPA 1957); *In re Schuelke*, 96 USPQ 421 (CCPA 1953); *In re Hertrich*, 73 USPQ 442 (CCPA 1947); *Long Mfg. N.C., Inc. v. Condec Corp.*, 223 USPQ 1213 (DC ENC 1984); *St. Regis Paper Company v. Bemis Company, Inc.*, 193 USPQ 8 (CA 7 1977); *Hofschneider Corp. v. Lane et al., doing business as Lane and Co.*, 71 USPQ 126 (DC WNY 1946).

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to modify the method taught by Watanabe et al by forming a barrier layer in the opening because it was known in the art that, in order to eliminate copper diffusion, a barrier layer must be used when forming copper interconnects.

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It would have been obvious to a person of ordinary skill in the art at the time the invention was made to optimize and select an appropriate implant energy, dosage and depth for the silicon ions. The selection of parameters such as energy, power, concentration, temperature, time, depth, thickness, etc., would have been obvious and involve routine optimization which has been held to be within the level of ordinary skill in the art. "Normally, it is to be expected that a change in temperature, or in concentration, or in both, would be an unpatentable modification. Under some circumstances, however, changes such as these may be impart patentability to a process if the particular ranges claimed produce a new and unexpected result which is different in kind and not merely degree from results of prior art...such ranges are termed 'critical ranges' and the applicant has the burden of proving such criticality...More particularly, where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation". *In Re Aller* 105 USPQ 233, 235 (CCPA 1955). See also MPEP 2144.05.

### ***Response to Arguments***

Applicant's arguments filed 11/17/03 have been fully considered but they are not persuasive.

Applicant argues that the silicon implantation of the present application is performed on a flat surface as shown in Fig. 2 (see bottom of p. 11 of arguments filed 11/17/03). This argument is not in commensurate scope with the claims since the claims do not recite such a limitation. Therefore, this argument is not persuasive.



Applicant argues that the plasma TEOS film of JP08102489A is not one of Applicants' preferred materials as recited in the claims (see top of p. 12 of arguments filed 11/17/03). However, plasma TEOS is a carbon-based silicon oxide, which is one of the materials recited in the independent claims. Therefore, this argument is not persuasive.

Applicant mainly argues that the term "low dielectric constant" means a dielectric constant of less than 3. However, such a definition is not found in the specification and is not supported by the specification. In fact, attributing the "less than 3" definition to the claim limitation "low dielectric constant" is in conflict with the specification. As examples of the "low dielectric constant material", the specification mentions alkyl silsesquioxane, FSG and PSG (see specification, bottom of p. 6 to top of p. 7). The dielectric constant of FSG, for example, is above 3 (see, for example, US Patent 6,558,747 to Nakata et al, col. 1, lines 33-34; US Patent 6,583,071 to Weidman et al, col. 2, lines 7-9; and US Patent 6,589,610 to Li et al, col. 3, lines 19-21). The preferred materials for the low dielectric constant material are porous or non-porous carbon-based silicon oxides, porous or non-porous organic polymers and porous or non-porous inorganic polymers. Many materials that fall into those categories have a dielectric constant greater than 3. Therefore, applicant's arguments are not found persuasive since construing the claims so narrowly is inconsistent with the specification.

***Conclusion***

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to J. L. Brophy whose telephone number is (571) 272-1835. The examiner can normally be reached on M-F (8:00-5:00).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Amir Zarabian can be reached on (571) 272-1852. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

J. J. B.

jlb

  
AMIR ZARABIAN  
SOUTHINGTON PATENT EXAMINER  
TECHNICAL STAFF